WATERSHED WORK PLAN

MILL CREEK WATERSHED

Elmore and Autauga Counties, Alabama

Prepared Under the Authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Cong., 68 Stat. 666) as amended.

Prepared by: Elmore County Commissioners Court

Elmore County Soil Conservation District

Central Alabama Soil Conservation District

With assistance by:

U. S. Department of Agriculture, Soil Conservation Service

U. S. Department of Agriculture, Forest Service

April, 1963

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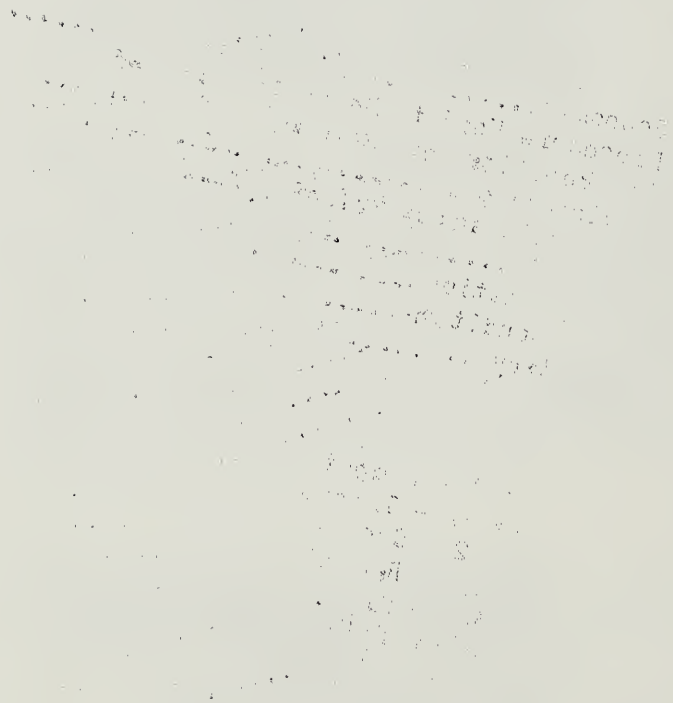

THE WATERSHED WORK PLAN

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Elmore and Autauga Counties, Alabama

April, 1963

SUMMARY OF PLAN

The Mill Creek Watershed has a total area of 6,790 acres, of which 3,630 acres are in Elmore County and 3,160 acres in Autauga County, Alabama. Mill Creek empties into the Alabama River. The Elmore County Commissioners Court; the Elmore County and the Central Alabama Soil Conservation Districts sponsored this project.

There are approximately 679 acres of land in this watershed subject to flood damage. The principal floodwater damage is to roads, bridges, septic tanks, yards, driveways of residences, residences and business establishments located in the floodplain. The Millbrook Community has a population of approximately 700 and a large part of the community is adjacent to Mill Creek and in the area subject to flood damage.

The objectives of the local people are: (1) To reduce the erosion and runoff from the upland and (2) To provide full protection from the expected 100 year frequency runoff for that part of the flood plain being used for residential purposes.

Types of works of improvement planned for this watershed.

(1) Land Treatment Measures.

The measures planned include grassed waterways, field border planting, hay planting, wildlife habitat development, tree planting, construction of farm ponds, improved forest management practices and terracing. These measures will be installed during a five-year period by individual landowners in cooperation with the Elmore County and Central Alabama Soil Conservation Districts. The estimated cost of installing these measures is $32,580; the P. L. 566 share being $4,000 or 12 percent and the other share being $28,580 or 88 percent. These measures will be operated and maintained by landowners in cooperation with the Elmore County and the Central Alabama Soil Conservation Districts.

(2) Structural Measures.

These measures consist of one floodwater retarding structure and 11,550 linear feet of channel improvement. These measures will be installed during the five-year installation period. The Elmore County Commissioners Court will install all structural measures by contract at an estimated total installation cost of $1,651,981. The P. L. 566 share will be $1,423,231 and the other share $228,750. The estimated annual cost of operation and maintenance is $5,825. The Elmore County Commissioners Court will perform all operation and maintenance.

The residences and business establishments in the floodplain area will be benefited by the structural measures. It is expected that approximately 390 acres presently in pasture and woods will be developed into residential properties. The floodplain land is the most valuable land in the watershed and values are as much as $1,500 per acre. Existing residences are valued as much as $18,000 each.

The estimated average annual cost for installing, operating and maintaining the flood prevention measures is $85,241 and the average annual benefits to be derived from these measures are estimated to be $143,088. This gives a benefit cost-ratio of 1.7 to 1 for the project.

DESCRIPTION OF THE WATERSHED

Physical Data

Location: Mill Creek empties into the Alabama River. Its watershed has an area of 6,790 acres in Elmore and Autauga Counties, Alabama. Alabama Highway No. 143 (Old Birmingham Highway) from Montgomery to Clanton, Alabama, traverses the watershed in a north-south direction passing through Millbrook. Alabama Highway No. 14 from Prattville to Wetumpka, Alabama traverses the watershed in an east-west direction passing through Robinson Springs. U. S. Highway No. 31 from Montgomery to Birmingham, Alabama borders the western edge of the watershed and Interstate Highway No. 65 will cross the western portion of the watershed paralleling U. S. Highway No. 31. The city of Montgomery is about five miles south, the town of Prattville about five miles west and the town of Wetumpka about 10 miles east of the watershed.

Climate: Average annual rainfall is 52 inches. Normally, October and November are the driest months. Thunderstorms and intense showers of short duration are common during the spring and summer months. Winters are relatively mild and summers are warm. There is an average growing season of 240 frost-free days between the last killing frost

of spring and the first killing frost of fall. Summer temperatures of 100 degrees Fahrenheit and above seldom occur. Protracted cold spells are rare. These climatological conditions are the average for this part of Alabama.

Land Use and Cover Conditions: The present land use within the watershed consists of approximately 856 acres of cropland, 1460 acres of improved pasture, 380 acres of idle land, 3945 acres of woodland and 149 acres in miscellaneous uses. The vegetative cover conditions on open land in the watershed are generally fair.

The present effectiveness of the upland forest and soil in regulating the behavior of surface runoff, is very poor compared to its potential. Forty percent of the forest soil is rated as being in very poor hydrologic condition; 50% poor; and 10% fair.

The combination of forest grazing, cultivation of areas now in trees, and forest fires has retarded the development of water absorbing soils. Twenty percent of the forest is being grazed. Sixty percent of the forest has been in cultivation within the past 50 years; these areas have not had time to develop their water absorbing capacities. Forest stands are being overcut. Poor quality or unmerchantable species have been left to occupy the stands. As a result, the volume of merchantable timber is less than one-fifth of the potential under managed use.

Water Courses: Mill Creek drains 6790 acres in Elmore and Autauga Counties, Alabama. Its headwaters originate in the southeastern corner of Autauga County and flows in an easterly direction into Elmore County and turns south emptying into the Alabama River. The channel flow is through the Millbrook Community.

Water Uses and Sources: Water for farm domestic use is obtained from dug and drilled wells. There are several farm ponds in the watershed. Livestock water is obtained from wells, farm ponds and creeks.

Geology

The watershed lies in the coastal plains physiographic province. The underlying materials are; sands, clays, gravels of the Tuscaloosa and Eutaw formations of Cretaceous Age. Two main divisions exist within the watershed with a sharp contrast between the two. The upper hilly portion of the watershed is high coastal plains and comprises about 70 percent of the area. The lower portion consists mainly of old terrace deposits of the Alabama River which are laid on the coastal plains material.

Topography

The topography varies from river terrace to rolling, hilly land. The relief ranges from 150 to 600 feet above sea level. The floodplains are suitable for crop and pasture production or urban development and are subject to flood damage.

Soils

The soils in the hilly portion of the watershed are coastal plains soils of predominantly sandy texture. The main upland soils are Orangeburg, Bowie and Faceville.

The lower part of the watershed has soils of river terrace and coastal plains origin. The main soils are Bowie, Kalmia, Myatt, Izagora and mixed alluvium of Mill Creek.

Other Physical Data

Approximately 33 percent of the farmers in the watershed have conservation plans with the Elmore County and Autauga County Soil Conservation Districts. Some plans will need revision to incorporate land treatment measures necessary to the overall watershed protection and flood prevention plan for the watershed. Individual landowners, in cooperation with the Elmore County and Central Alabama Soil Conservation Districts and the Agricultural Conservation Program, have terraced part of the cropland, improved channels and planted part of the steep land to trees, grasses and legumes.

Economic Data

There are approximately 78 farms in the watershed ranging in size from 12 to 760 acres. Livestock farming, mainly beef cattle and some dairying, is the only significant agricultural enterprise. Farming is confined largely to the upland portion of the watershed. A small portion of the upper end of the floodplain is used for pasture. The remaining floodplain (lower end) is occupied by the community of Millbrook. This area consists of homes, stores, service stations and other small businesses. The population of Millbrook is about 700 and is approximately six miles from Montgomery, the Capitol of Alabama.

Millbrook is an unincorporated community that began to urbanize many years ago. In the early days of its development, summer and weekend homes were built by the professional people of Montgomery. In the early forties, the working people from Montgomery began building in this area commuting to their jobs. Since World War II, and especially

in the last 10 years, this area has urbanized at a very fast rate. Many of the newer homes and business establishments have been built on areas that are subject to flood damage.

Land values in the lower end of this watershed are extremely high and are steadily increasing because of the rapid urban developments. The average value of this land ranges from $1,000 to $1,500 per acre. Residences have been and are continuing to be built in the flood damage area and the values of each range from $12,000 to $18,000.

Paved county, State, Federal and Interstate highways traverse this watershed in all directions. A cloverleaf (interchange) is planned for the Interstate Highway No. 65 at the southern edge of this watershed. The network of paved roads and proximity of this watershed to Montgomery improves the opportunity for continued urban developments.

Land values for the agricultural land in the upper portion of the watershed range up to $150 per acre, however, when the agricultural land is subdivided for residential uses the value immediately increases.

Excellent markets for all farm products are available in Montgomery.

WATERSHED PROBLEMS

Floodwater Damage

The most recent large floods on Mill Creek occurred in February 1961 and December 1961. Each of these floods caused extensive damage to roads, bridges, septic tanks, yards, driveways of residences, and residences located in the floodplain. These floods also damaged merchandise and equipment in the stores and delayed business activities. Following these floods, the Red Cross and County Health Officials provided help to the local residents in overcoming the disaster.

The expected 100-year storm will inundate an estimated 679 acres of floodplain land. The April 1955 storm approximated the 100-year storm. Approximately 540 acres of the floodplain land is in urban or residential area and 139 acres in other uses.

Approximately 100 acres of the urban or residential area has been or is being developed into an urban community. The estimated fair market value of residences on the floodplain land ranges from $12,000 to $18.000 each. There are approximately 440 acres of floodplain land in the urban or residential area subject to frequent overflow from floodwater and, therefore, cannot be fully developed under present conditions. Since these 440 acres are adjacent to the area now urbanized,

it is anticipated that this project will provide the level of protection necessary for the full development of these areas.

It is estimated that the present average annual damages amount to $24,590 (Table 5).

Sediment Damage

Sediment damages were not evaluated separately. The sediment carried by the stream is deposited on unproductive woodland or is carried completely through the watershed.

Erosion Damage

Damages due to floodwater scouring of the floodplain land are moderate. The only open land in the floodplain is either pasture or urban land which is not eroded by the shallow flooding.

Erosion of the upland is serious. The sandy soils erode badly on steep slopes and large gullies will form if erosion is not checked. The steep land is wooded or idle with some minor gullying. The few large gullies in the watershed have been stabilized.

Problems Relating to Agricultural Water Management

A study was made of the agricultural water management problems. It was determined that there were no problems of this type in the watershed that required project action.

At the present time, each residence in the Millbrook Community obtains its water supply from an individual well. Through community efforts they have planned a community water supply and distribution system. The source of water will be from an underground supply. The group feels that this will be more satisfactory than surface storage that could have been included in the plan.

PROJECTS OF OTHER AGENCIES

There are no county, State or Federal water resource developments under construction or planned which will be affected by the works of improvement in this work plan. The proposed Jones Bluff Dam, a U. S. Corps. of Engineer project, is located on the Alabama River below the confluence of Mill Creek with the river. The maximum flood stage elevation (125 feet MSL) of this dam will not affect any land within the Mill Creek Watershed.

The Alabama Division of Forestry, in cooperation with the U. S.

Forest Service, is providing forest protection and management assistance to the private landowners in the watershed. These services are furnished under Section 2 of the Clarke-McNary Act and the Cooperative Forest Management Act. There are no National Forest lands within this watershed.

BASIS FOR PROJECT FORMULATION

The objectives of this watershed project are: (1) To reduce erosion and runoff on the uplands and, (2) To provide full protection from the 100-year flood for that part of the floodplain to be used as residential areas.

There are approximately 540 acres of floodplain land in the urban or residential area subject to frequent overlow from floodwaters. About 100 acres has been, or is being developed, and the local people desire to continue the development on the adjacent areas.

To provide the desired level of protection, one floodwater retarding structure site was selected as near the area subject to damage as topography would permit. The site selected will control runoff from 69 percent of the entire watershed.

It was necessary to supplement the floodwater retarding structure with some type of channel improvement to provide the needed level of protection. Several alternatives were considered in planning the channel improvement. Alternatives considered included channel lining, set-back leeves, grade stabilization structures, open channel side slopes 1:1 and vegetated channel side slopes 4:1.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

The land treatment measures will be planned and applied under the accelerated program of the Elmore County and Central Alabama Soil Conservation Districts. The land treatment measures to be installed for watershed protection are based upon the principle of using each acre of land within its capability and treating it according to its needs.

The combination of land treatment measures to be installed on cropland includes terracing, contour cultivation, grassed waterways, conservation cropping systems, field border planting and wildlife habitat developments. These measures will control runoff, reduce sheet erosion, control gully erosion, provide adequate water disposal systems for the cropland and cause more water to enter the soil.

Existing pastures will be renovated by overplanting and fertilizing to provide more effective cover which will reduce runoff and erosion. Selected upland areas will be planted and managed for hay production. This will provide an improved cover condition which will reduce both runoff and sediment production. Cropland which is being used beyond its capability for sustained agricultural production and idle lands will be planted to grass. These land use adjustments will reduce runoff and erosion from the affected areas and will protect them for future agricultural use.

Trees will be planted on land which is more suitable for tree production than other uses. The planned increase in area and productivity of the grassland, together with some adjustment in fence arrangement, will permit more effective control of grazing on the woodland areas. This, together with tree planting and other improved management practices, will result in improved stands and an improvement in the hydrologic soil conditions of the woodland. Infiltration rates will be increased in these areas and runoff reduced.

The combined effects of the land treatment measures and land use adjustments will be a reduction in runoff and sheet erosion, improved soil conditions, and a protection of the land resources through sound land use.

Structural Measures

One floodwater retarding structure will be installed at the location shown in Figure 1. The total estimated cost of installation is $541,809 (Table 2). A typical floodwater retarding structure (Figure 2) consists of an earth-fill dam with a fixed drawdown tube and an emergency spillway. Its primary purpose is to detain runoff, allowing it to discharge through the drawdown tube at a predetermined rate. This structure, supplemented by channel improvement, will provide flood protection from the 6-hr-100 year frequency storm (determined by Technical Paper No. 40, U. S. Weather Bureau) for the Millbrook urban area. Sixty-nine percent of the Mill Creek Watershed area that contributes to direct flooding is above the floodwater retarding structure. The floodwater retarding structure provides for 3,497 acre-feet of floodwater storage or the equivalent of 8.97 inches of runoff from the area above the structure, or 6.18 inches of runoff from the watershed.

Suitable vegetative cover will be established on the embankment, spillway and borrow areas above the sediment pool elevation to provide adequate protection for the structure. A good stand and vigorous growth will be obtained before the structure is accepted for operations and maintenance. The sediment pool of the floodwater retarding structure

will be cleared of growth and debris and the borrow areas will be made self-draining. There are no depressions in the flood area that would retain water following flooding. The emergency spillway for the floodwater retarding structure will be installed at the most strategic location to keep the flow of water away from the dam. See Table 3 for additional structural data.

Approximately 2.2 miles of channel will be improved at the location shown in Figure 1. The estimated cost of channel improvement is $1,110,172 (Table 2). The channel consists of 2,000 feet of reinforced concrete lined channel from Station 161+00 to 181+00 and 9,550 feet of earth channel with five gradient control drop structures at locations shown in Figure 1. The soil material in which the channel will be excavated is a poorly graded fine sand. A channel excavated in this material without controls would produce serious bank erosion in curves and degrading of the bottom. The spoil will be smoothed sufficiently to permit safe mowing or other maintenance practices. Provisions will be made for open ditches or pipes through the spoil bank, where necessary, to prevent a drainage problem. Pipe will be used to remove surface water, only where necessary, to prevent scour. The area of spoil draining toward the channel will be vegetated. See Table 3A for additional channel data.

The total estimated cost of the structural measures is $1,651,981 (Table 2). The annual cost including operation and maintenance is $85,241 (Table 4).

EXPLANATION OF INSTALLATION COSTS

Land Treatment

The cost of installing land treatment measures will be borne by landowners and operators with such assistance as may be available under other going programs. Technical assistance will be provided from P. L. 566 funds in the amount of $4000 and will be used in making soil surveys, farm conservation plans and applying land treatment measures.

The total estimated cost of land treatment measures is $32,580 (Table 1). The P.L. 566 share of this cost will be $4,000 or 12 percent and the other (non-P.L. 566) share will be $28,580 or 88 percent.

Structural Measures

The total estimated installation cost of the floodwater retarding structure is $541,809. The costs for construction, engineering services, (and other administrative, etc.) are $391,659. These costs will be

borne by P. L. 566 funds. The estimated construction cost is $302,106 which includes $32,368 for contingencies. The construction cost also includes an amount for the necessary vegetative stabilization. The estimated cost of the installation services needed to install the structure is $89,553. The remaining installation costs will be borne by Other funds. This cost is estimated to be $150,150. The estimated cost of land rights--land easements, and rights-of-way is $149,850, and the estimated cost of administering contracts is $300. This will be borne by the Elmore County Commissioners Court.

The total estimated installation cost for the concrete lined channel is $674,884. The P. L. 566 share of this cost is $666,584, and the remaining installation cost, $8,300 will be borne by other funds (Table 2). The five gradient control drop structures will have a total installation cost of $155,596. The P. L. 566 share of this cost is $145,446, and the other funds share is $10,150. The total installation cost for the earth channel improvement is $279,692. The P. L. 566 share of this cost is $219,542 and the remaining cost $60,150 will be borne by other funds (Table 2).

The total estimated installation cost of all stream channel improvement is $1,110,172. The costs for construction, engineering services, and Other (Administrative, etc) are $1,031,572. These will be borne by P. L. 566 funds. The estimated construction cost is $795,704 which includes $85,254 for contingencies. The construction cost also includes an amount for improved outlets, including pipes where needed, and the planned vegetation of the spoil. The estimated cost of installation services needed to improve the stream channel is $235,868. The remaining estimated installation cost for improving the stream channel is $78,600. This cost will be borne by Other funds. The cost of land, easements and rights-of-way is $78,000 and the estimated cost of administering contracts is $600 and will be borne by the Elmore County Commissioners Court.

The cost of land easements and rights-of-way shown in Tables 1 and 2 includes such items as land acquisition for the floodwater retarding structure, relocation of roads, culverts, fences and other improvements. Included in this cost is $105,000 above land values for relocating houses and roads.

It is estimated that funds will be obligated as follows:

Year	P. L. 566	Other	Total
First	$ 92,290	$ 172,300	$ 264,590
Second	382,000	66,430	448,430

Year	P. L. 566	Other	Total
Third	$ 950,000	$ 6,200	$ 956,200
Fourth	1,500	6,200	7,700
Fifth	1,441	6,200	7,641
Total	1,427,231	257,330	1,684,561

The total project installation cost is $1,684,561. The P. L. 566 share of this cost is $1,427,231 (85 percent) and the other (non-P.L. 566) cost is $257,330 (15 percent).

EFFECTS OF WORKS OF IMPROVEMENT

The planned works of improvement will provide full protection for the floodplain area from the expected 100-year frequency storm runoff. The 100-year storm would inundate 679 acres of floodplain area in this watershed under present conditions. After this project is installed, the structural measures will provide 100 percent protection.

The community of Millbrook is the urbanized area in the floodplain. It has a population of about 700 and is only six miles from Montgomery, Alabama. It is unincorporated, but the residences that have been built in the area subject to flood damage are valued from $12,000 to $18,000 each. The value of land ranges from $1,000 to $1,500 per acre.

About 100 acres of the floodplain are now developed or being developed into residential or urban area. The reduction of the flood hazard will relieve the homeowners in this area of the hardships that have followed recent storms. The merchants and other business people can continue their activities without fear of losses to property and interruptions of business. The Red Cross and local health officials will not have to provide assistance to the local residents following flood events.

There are 440 additional acres in the floodplain adjacent to the area already urbanized and it is reasonable to expect that 390 acres of this area will be urbanized. The local people can develop this area into residences without fear of floodwater damage.

PROJECT BENEFITS

The estimated damage reduction benefits from the installation of land treatment measures were not evaluated because the uncontrolled

area below the floodwater retarding structure is very small, and any reduction in runoff due to land treatment measures will be more than offset by the increase in runoff caused by the added numbers of businesses, homes and streets in this area.

The estimated floodwater damage reduction benefits accruing to structural measures amount to $24,590 annually. Included in this figure is $3,750 in road and bridge damage reduction benefits, and $3,200 in indirect damage reduction benefits. The remaining damage reduction benefits, $17,640,accrue as a result of reduced flooding of homes and business properties.

Land enhancement benefits in the amount of $106,470 accrue as a result of changed land use from agriculture to urban. These benefits were estimated on the basis of increased income due to agricultural land being converted to urban use.

Benefits accruing to more intensive use of existing pasture land amount to $1,300 annually on about 130 acres. These benefits were calculated on the basis of increased yield as a result of improved managerial practices made possible by the reduction of the flood hazard.

The value of local secondary benefits amount to $10,728 annually. They accrue as a result of increased net income to property owners, and to suppliers and builders of home and business establishments which can be constructed as a result of the project. Secondary benefits from a national viewpoint were not evaluated.

Other benefits from the project not evaluated includes the enhancement of fish and wildlife and other recreational opportunities in the watershed.

COMPARISON OF BENEFITS AND COSTS

The total average annual benefits, including local secondary benefits, accruing to structural measures amount to $143,088 and the average annual cost will be $85,241, with a benefit-cost ratio of 1.7 to 1. (See Table 6).

The total average annual benefits without local secondary benefits amount to $132,360 and the average annual cost will be $85,241; this will give a benefit-cost ratio of 1.6 to 1.

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PROJECT INSTALLATION

Land Treatment Measures

Land treatment measures will be established within the five-year installation period by the individual farmers in cooperation with the Elmore County and Central Alabama Soil Conservation Districts. The Districts will provide technical assistance for the planning and application of these measures. The Soil Conservation Service, using P. L. 566 funds, will supplement the assistance provided under the going District program. This additional technical assistance will accelerate the rate of planning and application of these land treatment measures. The Alabama Division of Forestry, in cooperation with the U. S. Forest Service, will provide two man-months of technical assistance to this project. Cost for this service will be borne by the going Cooperative Forest Management Program. Assistance available under the Agricultural Conservation Program will be used in establishing the land treatment measures.

Structural Measures

The Elmore County and Central Alabama Soil Conservation Districts will obtain agreements from farm owners and operators to carry out recommended soil and water conservation measures on not less than 50 percent of the land situated in the drainage area above the floodwater retarding structure. These agreements will be obtained prior to any P. L. 566 funds being provided for the construction of this structure. Prior to providing financial assistance for the construction of any planned structural measures, at least 75 percent of the effective land treatment measures must be installed or their installation commenced on these sediment source areas which, if uncontrolled, would require a material increase in the cost of construction, operation or maintenance of the structural works of improvement.

The structural measures will be installed during the five-year installation period after the necessary easements are obtained and after the above mentioned requirements are met. All necessary land, easements, and rights-of-way will be obtained for floodwater retarding structure No. 1 before P. L. 566 funds for construction are made available.

The channel improvement works will be installed after the floodwater retarding structure is installed. All necessary land, easements, and rights-of-way will be obtained for the channel improvement works before P. L. 566 funds for construction are made available.

The Elmore County Commissioners Court will be responsible for all costs of acquiring the needed land, easements, and rights-of-way

for the installation of all structural measures. The Elmore County Commissioners Court will install all of these measures by contract and will finance the local administration of contracts. The installation cost of these structural measures will be shared in accordance with the provisions of P. L. 566 as amended. Public Law 566 funds will be used for cost involved in construction and the needed installation services.

FINANCING PROJECT INSTALLATION

The Elmore County Commissioners Court will secure all needed land, easements and rights-of-way at no expense to the Federal Government. They will also provide legal services, miscellaneous expenses and make all necessary alterations in roads, bridges and culverts.

The sponsoring organizations plan to raise needed funds for this project by means other than taxation. However, if it becomes necessary to use funds from taxation, the money will be from a general tax fund rather than from a special taxation.

It is not expected that any part of the local cost will be borne by borrowing from private or Farmers Home Administration sources.

Federal assistance for carrying out the works of improvement, as described in this work plan, will be provided under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Cong., 68 Stat. 666 as amended), and is contingent on appropriations of funds for this purpose.

Individiaul landowners and operators may request cost-sharing assistance under the Agricultural Conservation Program in applying land treatment measures.

Installation services will be provided by the Federal Government for the installation of structural measures.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

Land treatment measures will be operated and maintained by landowners and operators under cooperative agreements with the Elmore County and Central Alabama Soil Conservation Districts.

Structural Measures

The Elmore County Commissioners Court will be responsible for the operation and maintenance of the structural works of improvement and will provide the necessary funds, labor and materials for such services. The kind of operation and maintenance work needed will include the removal of sandbars, undesirable vegetation, logs, stumps and other debris from the channels. The vegetation on the floodwater retarding structure and adjacent areas will need to be fertilized adequately to maintain a vigorous growth for good ground cover. The trash racks and emergency spillways will need to be cleaned out. The invert elevation and the capacity of the three culverts under Elmore County Highway No. 2 (Station 262+50) will be maintained at their present elevation and capacity. The Elmore County Commissioners Court will enter into maintenance agreements with the Service before Federal financial assistance is provided for structural measures. The estimated annual cost of operation and maintenance during the expected life of the improvement is $5,825 (Table 4).

A representative of the sponsoring local organization will make annual inspections to determine the conditions of the structural works of improvement. A record of maintenance inspections and maintenance operations will be on file with the sponsoring organization. The Soil Conservation Service will make periodic checks, at least once a year, with a representative of the sponsoring organization to see that adequate maintenance is being performed according to agreements.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COSTS

Mill Creek Watershed, Alabama

Installation Cost Item	No. to be Applied		Estimated Cost (Dollars) 1/		Total
	Unit	Non-Fed. Land	P.L. 566 Funds Non-Fed. Land	Other Non-Fed. Land	
LAND TREATMENT					
Soil Conservation Ser.					
Cropland	acres	600		4,030	4,030
Grassland	acres	1,935		21,650	21,650
Technical Assistance			4,000	500	4,500
SCS Subtotal			4,000	26,180	30,180
Forest Service					
Forest Land	acres	3,961		1,000	1,000
Technical Assistance				1,400	1,400
FS Subtotal				2,400	2,400
TOTAL LAND TREATMENT			4,000	28,580	32,580
STRUCTURAL MEASURES					
Soil Conservation Ser.					
Floodwater Retard.Str.	No.	1	302,106		302,106
Drop Structure	No.	5	112,190		112,190
Concrete Lined Ch.	Lin.Ft	2,000	514,170		514,170
Ch. Improvement	Lin.Ft	9,550	169,344		169,344
Subtotal Construction			1,097,810		1,097,810
INSTALLATION SERVICE					
Soil Conservation Ser.					
Engineering			196,038		196,038
Other			129,383		129,383
Subtotal Instl. Ser.			325,421		325,421
OTHER COSTS					
Land E&RW				227,850	227,850
Adm. of Contracts				900	900
Subtotal Other				228,750	228,750
TOTAL STRUCTURAL MEASURES			1,423,231	228,750	1,651,981
TOTAL PROJECT			1,423,231	257,330	1,684,561
SUMMARY					
SCS Subtotal			1,427,231	254,930	1,682,161
FS Subtotal				2,400	2,400
TOTAL PROJECT			1,427,231	257,330	1,684,561

1/ Price base 1962

DATE: April 1963

TABLE 2 - ESTIMATED STRUCTURE COST DISTRIBUTION

Mill Creek Watershed, Alabama
(Dollars) 1/

Structure Site No. and Name	Installation Cost P.L.566 Funds				Installation Cost - Other Funds			Total Instl. Cost
		Instl. Services		Total P.L.566	Other		Total Other	
	Construction	Engineering	Other		Admin. Contr.	E&R/W		
FRS #1	302,106	53,948	35,605	391,659	300	149,850 2/	150,150	541,809
Channel Improvement								
Concrete Lined	514,170	91,816	60,598	666,584	300	8,000	8,300	674,884
Earth	169,344	30,240	19,958	219,542	150	60,000	60,150	279,692
Drop Str. 1, 2,3,4,& 5	112,190	20,034	13,222	145,446	150	10,000	10,150	155,596
SUBTOTAL CHANNEL IMPROVEMENT	795,704	142,090	93,778	1,031,572	600	78,000	78,600	1,110,172
GRAND TOTAL	1,097,810	196,038	129,383	1,423,231	900	227,850	228,750	1,651,981

DATE: April 1963

1/ Price base 1962

2/ Includes $105,000 for relocation of major fixed improvements

TABLE 3 - STRUCTURE DATA
FLOODWATER RETARDING STRUCTURE

Mill Creek Watershed, Alabama

ITEM	Unit	STRUCTURE NUMBER 1
Drainage Area	sq.mi.	7.31
Storage Capacity		
Sediment	ac.ft.	631 1/
Floodwater	ac.ft.	3,497
Total	ac.ft.	4,128
Between high and low stages	ac.ft.	--
Surface Area		
Sediment Pool	ac.	35
Floodwater Pool	ac.	208
Volume of fill	cu.yds.	444,896
Elevation Top of Dam	ft.	329.5
Maximum height of dam	ft.	64.0
Emergency Spillway		
Crest Elevation	ft.	320.0
Bottom Width	ft.	200
Type		veg.
Percent chance of use		1%
Ave Curve No. - Cond.II		72
Emergency Spillway Hydrograph		
Storm rainfall (6-hr.) 3/	in.	12.23
Storm runoff	in.	8.55
Velocity of flow (v_c)	ft./sec.	2/
Discharge Rate	c.f.s.	2/
Max.W.S. Elev.	ft.	2/
Freeboard Hydrograph		
Storm rainfall (6-hr.) 3/	in.	30.58
Storm runoff	in.	26.36
Velocity of flow (v_c)	ft./sec.	13.7
Discharge rate	c.f.s.	17,700
Max. W. S. Elev.	ft.	329.5
Principal Spillway		
Capacity-low stage	c.f.s.	215
Capacity-high stage	c.f.s.	---
Capacity Equivalents		
Sediment Volume	in.	1.62
Detention Volume	in.	8.97
Spillway Storage	in.	5.62
Class of structure		c

1/ 100-year sediment yield 311 ac.ft. in sediment pool and 320 acre ft in flood pool.
2/ No emergency spillway flow during hydrograph.
3/ 13.9" modified by Fletcher curve and in accordance with SCS Eng.Memo #27.

DATE: April 1963

TABLE 3A - STRUCTURAL DATA

GRADIENT CONTROL DROP STRUCTURES
Type C
Mill Creek Watershed, Alabama

Site No.	Planned Capacity (cfs)	Drop (ft)	Depth of Weir (ft)	Length of Weir (ft)	Length of Apron (ft)	Concrete (Cu.yds.)
1 1/	1600	7.0	5.0	46	21	142
2 2/	1600	6.0	5.5	40	6/	111
3 3/	1600	8.0	6.0	40	23	119
4 4/	1600	8.0	6.0	40	23	150
5 5/	1850	8.0	6.0	46	26	173

1/ Located at Station 147+00
2/ Located at Station 161+00
3/ Located at Station 181+00
4/ Located at Station 203+50
5/ Located at Station 226+00
6/ Concrete lined channel

DATE: April 1963

TABLE 3B- STRUCTURE DATA

CHANNELS
Mill Creek Watershed, Alabama

Channel Designation	Sta. Number for Reach		Watershed Area	Planned Channel Capacity	Bottom Width	Side Slope	Depth	Grade	Manning's "n"	Velocity in Channel	Volume of Excavation
	Station (100 ft)	Station (100 ft)	(sq.mi)	(cfs)	(ft)		(ft)	(ft/ft) 4/		(ft/sec)	(1000 cu.yds)
Mill Creek	147+00 2/	161+00 2/	1.9	1600	90	1:1	5.8	.00049	.035	2.86	46
	161+00 1/	181+00 2/	1.9	1600	40	vert	5.5	.00077	.015 5/	7.27	29
	181+00	203+50 2/	1.9	1600	100	1:1	5.9	.00038	.035	2.56	83
	203+50	226+00 2/	2.25	1850	100	1:1	6.0	.00049	.035	2.91	108
	226+00	262+50 3/	2.37	1950	100	1:1	11.9	.00007	.035	1.61	162

DATE: April 1963

1/ Concrete lined channel station 161+00 to 181+00
2/ Location drop structure
3/ Three 10.5 ft C.M. culverts under paved county road will act as control point.
4/ Average grade determined by water surface profile computations.
5/ .015 was used for capacity design, .012 was used to analyze hydraulic functioning.

TABLE 4 - ANNUAL COST

Mill Creek Watershed, Alabama

(Dollars)[1/]

Evaluation Unit	Amortization of Instl.Cost	Operation and Maint.Cost	Total
FRS #1 and Mill Creek Channel Improvement	79,416	5,825	85,241
TOTAL	79,416	5,825	85,241

1/ Price base, installation cost of FRS amortized @ 2-7/8 % interest for 100 years; cost of channel improvement amortized @ 2-7/8% interest for 25 years. Operation and Maintenance cost long-term projected prices.

DATE: April 1963

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Mill Creek Watershed, Alabama

(Dollars)[1/]

ITEM	Estimated Average Annual Damage		Damage Reduction Benefits
	Without Project	With Project	
Floodwater			
Nonagricultural			
Residences and business property	17,640	0	17,640
Roads and bridges	3,750	0	3,750
Subtotal	21,390	0	21,390
Indirect	3,200	0	3,200
TOTAL	24,590	0	24,590

1/ Price base, long-term projected prices.

DATE: April 1963

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Mill Creek Watershed, Alabama

(Dollars)[1/]

Evaluation Unit	Average Annual Benefits					Average Annual Cost	Benefit Cost Ratio
	Flood Prevention						
	Damage Reduction	More Intensive Land Use	Changed Land Use Urban	Other[2/]	Total		
FRS #1 and Mill Creek Channel Improvement	24,590	1,300	106,470	10,728	143,088	85,241	1.7:1
TOTAL	24,590	1,300	106,470	10,728	143,083	85,241	1.7:1

1/ Price base, Annual Benefits and Operation and Maintenance cost based on long-term projected prices. Annual equivalent installation cost based on 1962 prices.

2/ Secondary Benefits.

DATE: April 1963

TABLE 7 - CONSTRUCTION UNITS

Mill Creek Watershed, Alabama

(Dollars)[1/]

Measures in Construction Unit	Annual Benefit	Annual Cost
FRS #1	58,852	17,940

1/ Price base, Annual Benefits
Long-term projected prices
Annual Cost - 1962 prices

DATE: April 1963

INVESTIGATIONS AND ANALYSES

Economic

Basic data used in the economic investigations and analyses were obtained from local home and business owners, realtors, bankers and the tax assessor. This data formed the basis for estimating the value of buildings and other fixed improvements in the area subject to flooding. Long-term projected prices were derived from data furnished by the Agricultural Research Service and Agricultural Marketing Service, September 1957.

Flood damage schedules were obtained from approximately 35 percent of the homeowners and business operators in the floodplain. Information was collected on depth, duration, and frequency of flooding. Flood damage information was obtained for the December 1961 flood, as a base point, and estimated for flood stages one-foot higher and one-foot lower. This damage information was evaluated and summarized for various flood stages and used in the preparation of a stage-damage curve. The hydrologist developed the relationships between stage and discharge, and between discharge and percent chance of occurrence. From this data, and from the stage-damage data, a damage-frequency curve was developed. The product of the values of one-inch of abscissa and one-inch of ordinate of the damage-frequency curve was obtained. This unit value per square inch was multiplied by the total square inches enclosed by the curve to get the average annual floodwater damages.

More intensive use benefits were calculated on the basis of expected increase in pasture yields. This increase in yield level would result from increased use of fertilizers, and better managerial practices made profitable by reducing the flood hazard. These benefits will accrue on about 130 acres.

The evaluation of local secondary benefits induced by the project were derived by applying a 10% factor to the sum of all primary project benefits (excluding indirect benefits). Local secondary benefits stemming from the project were based on the difference in construction cost with and without the project for local residences and related items such as streets and sewers. This difference in construction cost was reduced to an average annual equivalent. A ten percent factor was applied to this annual equivalent cost and also to the annual equivalent associated cost and to the annual operation and maintenance cost to get the total secondary benefits.

Changed land use from agricultural to urban was based on information obtained from landowners and operators as to their intentions in

regard to flood plain use after the project is installed. Consideration was given to the trend toward this type of development in this area.

Changed land use benefits (from agricultural to urban residences) were developed by determining the difference in net returns from changed land use by estimating the increase in income or rental value of land and improvements due to the project. These benefits will accrue on approximately 390 acres of flood plain land protected from the 100-year frequency flood. Consideration was given to the expected percent occupancy in determining this area. Associated costs necessary to increase the net returns on this area were deducted to obtain the net benefit attributable to the project.

The present floodwater damage to a small area of pasture land was not evaluated as a separate item because this damage and the resulting benefits would be very small when compared to the total project benefits.

One floodwater retarding structure and channel improvement are needed to give the desired degree of protection from flooding. These structures were evaluated hydrologically and economically as a unit.

The value of land easements and rights-of-way and the estimated cost of relocating major fixed improvements were furnished by the Elmore County Commissioners Court. Values of land needed for structural measures were compared with values of other comparable land in the watershed. Estimates were based on current market values. The estimated value of easements and rights-of-way is $227,850. Included in this cost is $105,000 for relocation or alteration of major fixed improvements such as; houses, roads, culverts and bridges above the floodwater retarding structure. It will require 299 acres of land easements and rights-of-way for the floodwater retarding structure and 39 acres for channel improvement. The area of land easements and rights-of-way required for channel improvement does not include the area voided by the existing channel.

The loss of net income in the pool area of the floodwater retarding structure was found to be less than the amortized value of easements and rights-of-way, therefore, there are no other economic costs applicable to the project.

PROCEDURE USED TO DETERMINE CHANGED LAND USE BENEFITS PER ACRE OF FLOOD PLAIN

Mill Creek Watershed, Alabama

Capital Costs

Land (2 lots) Per Acre		$ 3,000
Sewage, streets, water, etc.		1,500
(2) Residences		25,500
Total Capital Costs		$ 30,000
Amortized - 50 years @ 6%	$ 1,903	
Annual Costs of Taxes, Insurance & Maint.	300	
Total Annual Costs	$ 2,203	

Income

Rent $210/month for 2 Residences	$ 2,520
Annual returns per ac.(2,520-2,203)	317
Less Annual returns from Agri. (Use (Woods & Pasture)	10
Difference in Net Returns Per Acre	$ 307

Discount for lag in accrual (6%-5 yrs.) $273 = Net Annual Returns 1/

1/ Price base, long-term projected prices.

DATE: April 1963

ENGINEERING

All surveys used in making hydrologic determinations and engineering design were referenced to USGS bench marks. A one-foot interval contour map was made of the Millbrook urban area. Valley and channel cross sections were taken at predetermined locations and the distance between the sections was scaled from contact prints.

Eleven thousand five hundred and fifty feet of channel improvement was planned to give flood protection for the 6-hr-100 year frequency storm as determined by Technical Paper No. 40, U. S. Weather Bureau. This channel consists of 2,000 feet of reinforced concrete lined channel and 9,550 feet of earth channel with five gradient control drop structures. The soil material in which the channel will be excavated is a poorly graded fine sand. A channel excavation in this material without controls would produce serious bank erosion in curves and degrading of the bottom. The natural slope of the valley is about 0.004 feet per foot.

The downstream end of the channel improvement will begin at a paved county road. Three 10.5 foot diameter C.M. pipes through the road fill will act as a transition. From this point upstream to drop structure No. 5 the channel will have a bottom grade of approximately 0.00095 feet per foot. From water surface profile computations for the design storm, the weir of structure No. 3 would be submerged a maximum of 0.8 of foot and the water surface would have a mean gradient of 0.00007 feet per foot and a mean velocity of 1.61 feet per second at design capacity. From Structure No. 5 to Structure No. 4, the channel bottom will have a zero grade, a water surface gradient of 0.00049 feet per foot, and a velocity of 2.91 feet per second. From structure No. 4 to structure No. 3, the channel bottom will have a zero grade, a water surface slope of 0.00038 feet per foot, and a velocity of 2.56 feet per second. The installation of these drop structures will not insure complete stability of the channel banks but some bank erosion can be tolerated in this reach.

The concrete lined channel begins at drop structure No. 3 and extends through the Millbrook urban area to drop structure No. 2. A lined channel is necessary in this reach to insure the stability of both the banks and channel bottom. A channel having subcritical flow was designed from Station 161+00 to 181+00. A Manning's "n" of .015 was used to determine the dimensions of the channel and .012 was used to determine the critical flow range.

An earth channel from station 147+00 to 161+00 was designed to have channel bottom grade of zero, a water surface gradient of 0.00049 feet per foot, and a mean velocity of 2.86 feet per second.

Drop structure No. 1 with its appurtenances will return all upstream over-flow water to the improved channel.

The floodwater retarding structure was located as close to the urban area as was feasible topographically. The contour map was made on an enlarged photograph by using the telescopic alidade and plane table. Stage-storage curves were developed from this map.

U. S. Weather Bureau records were searched and the most critical storm on record was an eight-day rainfall of 20.72 inches occurring in August 1939 at Prattville, Alabama. The most critical part of this storm was 19.56 inches of rainfall occurring in 96 hours. The 19.56 inch rainfall was converted to 11.95 inches of runoff by using an antecedent moisture condition of I for the first day and III for the remaining days. A detention volume of 8.97 inches was determined by"quickie" routing the 11.95 inches of runoff through the structure at an average release rate of 29.41 CSM.

The minimum design criteria for this structure was exceeded because of the following: The emergency spillway will be located in highly erosive material and it will be difficult to establish and maintain an adequate erosion-resistant vegetative cover. Failure of this dam would cause the loss of a number of lives, serious damage to homes, commercial buildings, public utilities, and main highways. Additional protection for expensive downstream channel improvement is needed. There would be an increase in construction cost of about four percent.

The freeboard hydrograph was flood routed by computing and plotting the inflow hydrograph and parabolas representing various emergency spillway discharges.

The foundation for the floodwater retarding structure is a poorly graded fine sand having a high water table. An upstream blanket with a low permeability and a blanket filter drain were planned for the dam.

Hydraulic and Hydrologic

The Hydrologist and Economist considered both agricultural and urban areas when selecting the location of valley cross sections in the watershed. Sections were selected to determine the effects of various frequency storms at specific locations. The locations included areas of existing and future housing and industrial development. The cross sections, referenced to mean sea level elevation, were rated by use of the variation of Leach's method of computing water surface profiles as outlined in Paragraph 4.1 of Supplement A, National Engineer-

ing Handbook, Section 4. Stage versus discharge curves were constructed for each cross section.

Hydrologic conditions of the watershed were determined by considering such factors as soils, land use and vegetative cover. From this, soil-cover complex data were assembled, and rainfall runoff relationships were computed for use in determining the runoff from various frequency storms.

Technical Paper No. 40, U. S. Weather Bureau, was used to obtain the rainfall for storms to be routed. The runoff from the 2-year, 10-year, 50-year, and 100-year, six-hour rainfalls was valley flood routed by the storage-indication method as outlined in Section 3.17 of Supplement A, National Engineering Handbook, Section 4. The runoff from the 2-year, six-hour rainfall, when routed through the valley, approximated the stage reached by the December 1961 flood and the 100 year, 6 hour rainfall, when routed through the valley approximated the stage reached by the April 1955 flood.

Relationships between Frequency-Stage-Damage were developed for the urban reach.

To meet the minimum requirements for level of protection for urban areas, as set forth in the Watershed Protection Handbook, the works of improvement should provide protection against major damages resulting for a recurrence of the largest storm of record or from one of 100-year frequency, whichever is greater. The runoff from the 100-year, six-hour rainfall from Technical Paper 40, U. S. Weather Bureau, was routed through the valley for future conditions. Protection was provided against damages from the peak discharge obtained from this routing.

Geologic

Geologic investigations consisted of a study of the literature pertaining to the area, field reconnaissance, and a study of outcrops and road cuts. The structure sites were investigated by surface examination and probing of the alluvial materials.

The foundation of the floodwater retarding structure and of the drop structures is a poorly graded fine sand having a high water table. Additional subsurface investigations will be made at each site for final design.

Sedimentation

Field and stereoscopic examinations were made of the floodplain and watershed to determine the extent and kind of sediment and erosion

damages.

Sheet erosion was estimated using "Suggested Procedures for Developing Annual Rates of Sheet Erosion". Gully erosion was estimated in the field since the gullies are of small size.

Cover conditions were mapped in the field by the Geologist and Hydrologist.

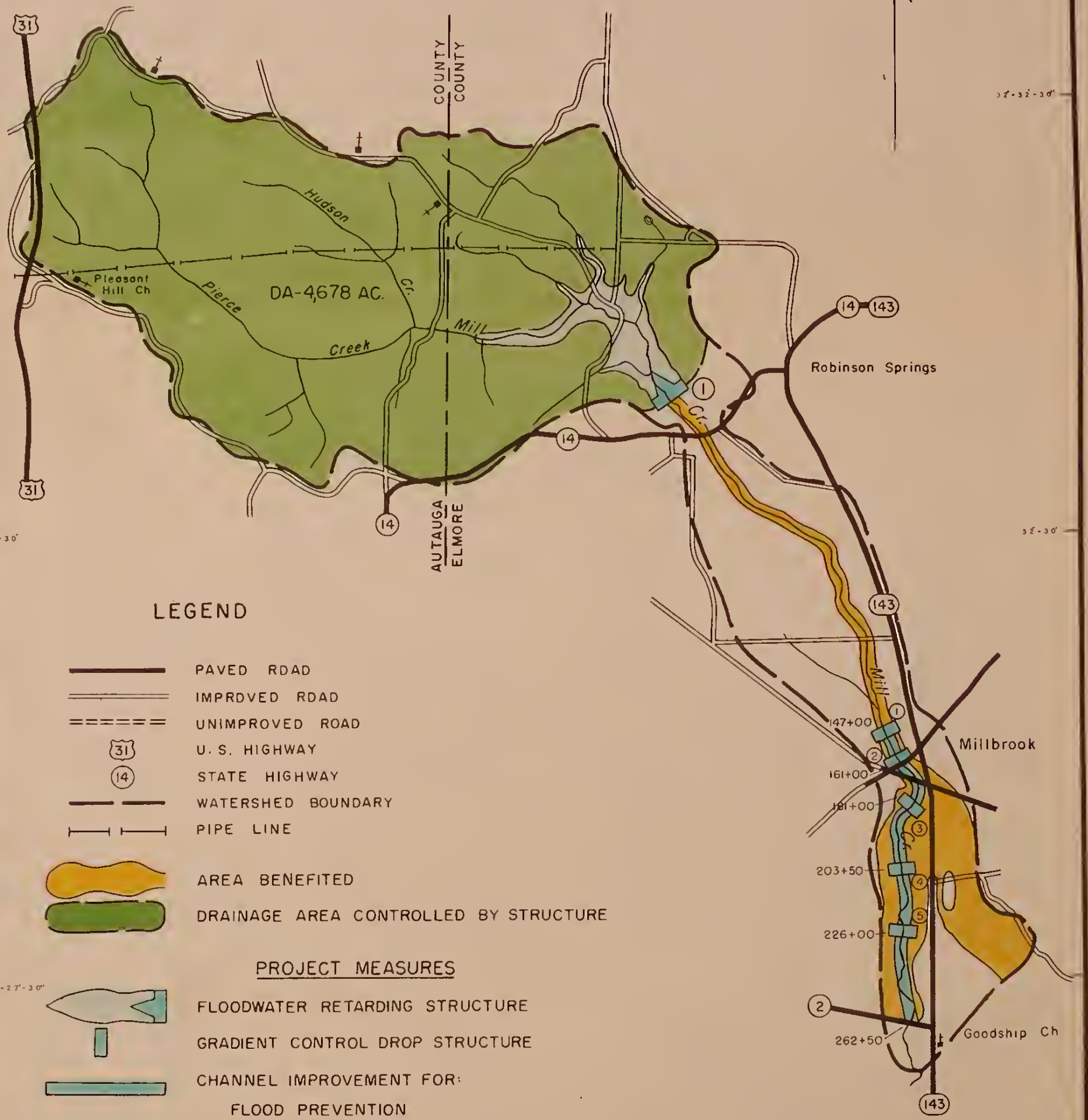
The sediment storage requirements for the floodwater retarding structure were determined as outlined in Technical Release No. 12. Computations were based on 100-year sediment requirements.

Soil Conditions

A soil survey report was published for Elmore County in September 1955. Soil surveys in Autauga County are completed for the portion of the county in the watershed. The available surveys were used in conjunction with field studies for determination of soil conditions.

Forestry

Upland forest conditions were determined by a field survey. Ground cover, hydrologic and forest conditions, treatment needs and measures were inventoried by systematically located samples throughout the upland forest in the watershed. The field survey was supplemented with data from other surveys, consultations with other agencies, and discussions with forestry officials to determine the quantity of the remedial measures. Program recommendations were developed to include that amount of work which may be installed during the program installation period. These measures include only those which contribute directly to flood prevention and soil stabilization.



LEGEND

- PAVED RDAD
- IMPRDVED RDAD
- UNIMPROVED ROAD
- (31) U. S. HIGHWAY
- (14) STATE HIGHWAY
- WATERSHED BOUNDARY
- PIPE LINE
- AREA BENEFITED
- DRAINAGE AREA CONTROLLED BY STRUCTURE

PROJECT MEASURES

- FLOODWATER RETARDING STRUCTURE
- GRADIENT CONTROL DROP STRUCTURE
- CHANNEL IMPROVEMENT FOR:
  FLOOD PREVENTION

FIGURE 1

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PROJECT MAP
MILL CREEK WATERSHED

PORTIONS OF

AUTAUGA AND ELMORE COUNTIES

ALABAMA

0 1/2 1 2 MILES

MARCH 1962

APRIL 1963

USDA SCS SPARTANBURG S C 1963

MR63-166

FIGURE 1A

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

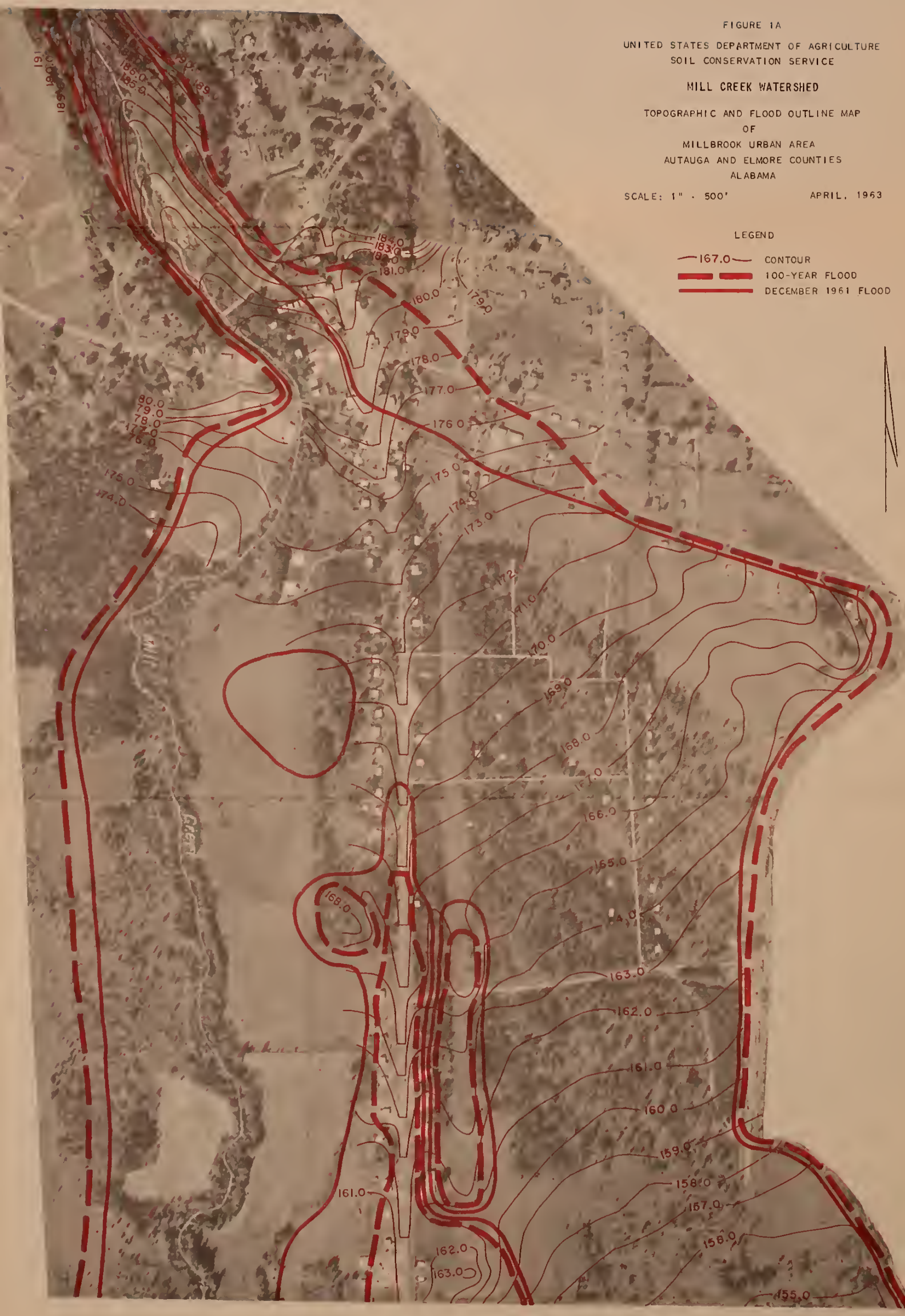
MILL CREEK WATERSHED

TOPOGRAPHIC AND FLOOD OUTLINE MAP
OF
MILLBROOK URBAN AREA
AUTAUGA AND ELMORE COUNTIES
ALABAMA

SCALE: 1" = 500' APRIL, 1963

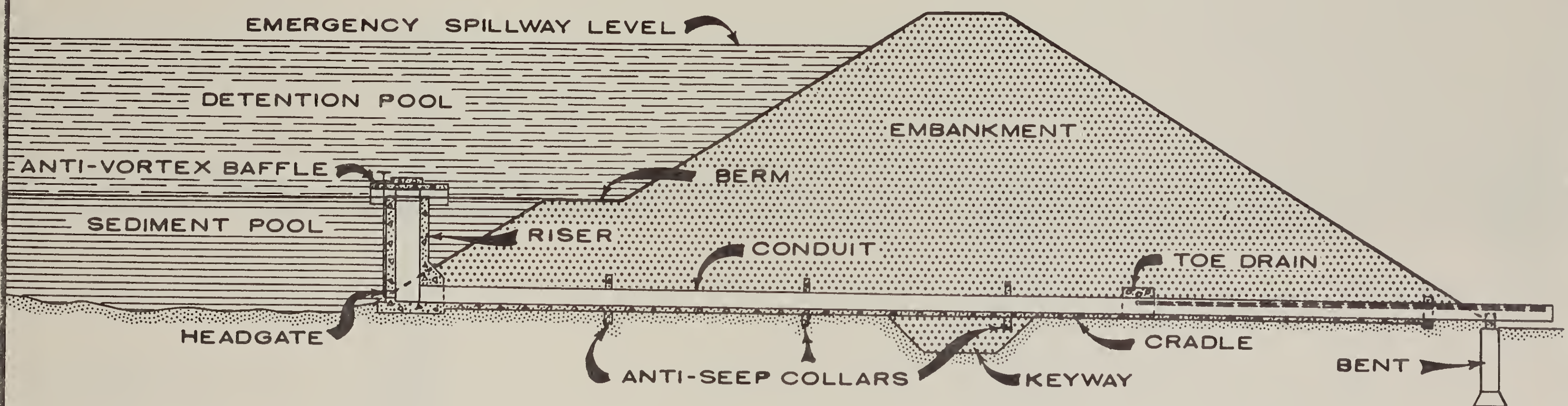
LEGEND

167.0 — CONTOUR
100-YEAR FLOOD
DECEMBER 1961 FLOOD



UNITED STATES
DEPARTMENT OF AGRICULTURE

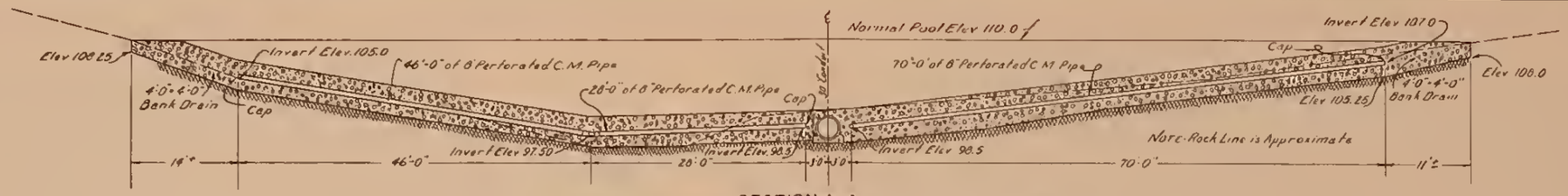
SOIL CONSERVATION SERVICE
SPARTANBURG, SOUTH CAROLINA



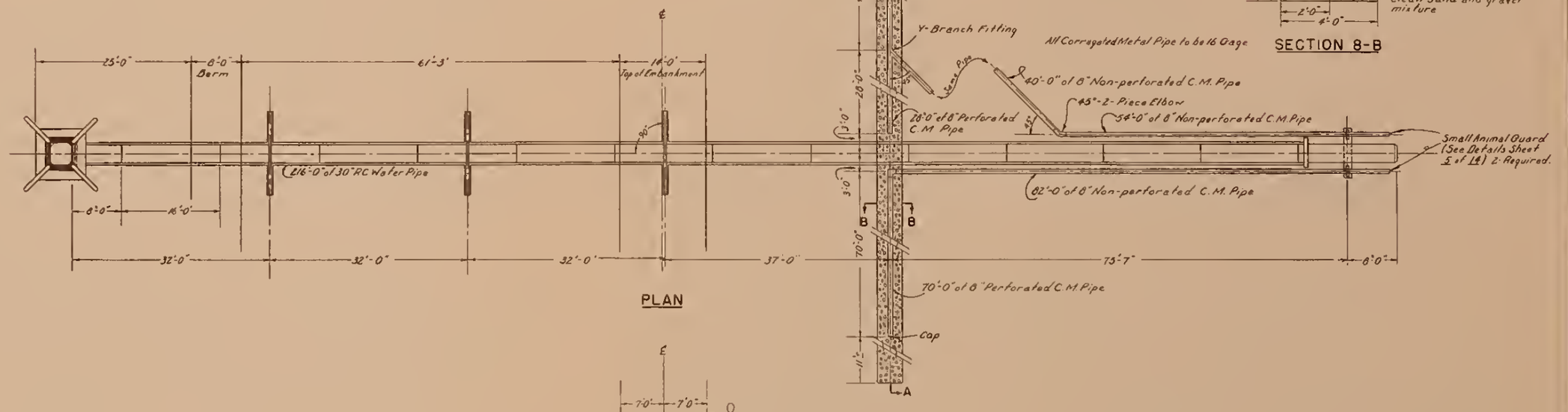
SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

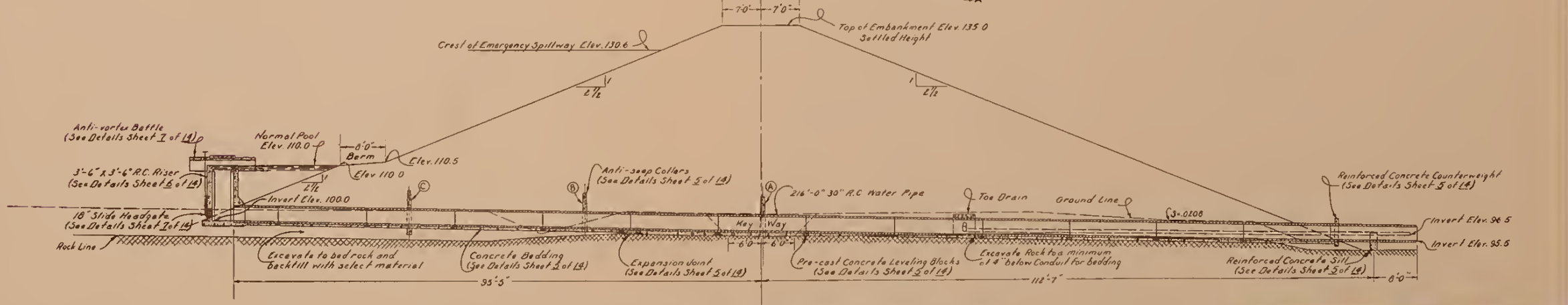
FIGURE 2

MR56-209



SECTION A-A
ELEVATION ALONG CENTERLINE OF 8" PERFORATED C.M. PIPE





SECTION ALONG CENTERLINE OF 30" REINFORCED CONCRETE PIPE
STA. 4+33 CENTERLINE OF DAM

PLAN
TYPICAL FLOODWATER
RETARDING STRUCTURE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Date		
Designed	Approved by	
Drawn	Title: STATE CONSERVATION ENGINEER	
Traced	Title: E.W.P.U. - DESIGN ENGINEER	
Checked	Sheet No. of	Drawing No. FIGURE 3

MR56-201